3. CHEMICAL AND PHYSICAL INFORMATION

3.1 CHEMICAL IDENTITY

The chemical identities of zinc and selected zinc compounds are provided in Table 3-1.

3.2 PHYSICAL AND CHEMICAL PROPERTIES

Important physical and chemical properties of zinc and selected zinc compounds are listed in Table 3-2.

TABLE 3-1. Chemical Identity of Zinc and Selected Compounds[a]

Characteristic	Zinc	Zinc chloride	Zinc sulfate
Synonym(s)	Zinc dust; zinc powder	Butter of zinc; chlorure de zinc (French); zinc (chlorure de) (French); zinc butter; zinc chloride ($ZnCl_2$); zinc dichloride; zinco (cloruro di) (Italian); zinkchlorid (German); zinkchloride (Dutch)	Sulfate de zinc (French); sulfuric acid zinc salt; sulfuric acid, zinc salt (1:1); white copperas; white vitriol; zinc sulfate; zinc vitriol; zinci sulfas; zincum sulfuricum
Registered trade name(s)	Asarco; L 15; Blue powder; CI 77945; CI pigment Metal 6; Emanay zinc dust; Granular zinc; JASAD; Merrillite; PASCO	Tinning flux (DOT)[c]; AI3-04470; Zintrace	Bonazen[c]; Medizinc; Bufopto Zinc sulfate; Op-thal-zin; Optraex; Solvenzink; Verazinc; Zincate; Zincomed; Zinkosite; AI3-03967; Orazinc; Zinc-200; Zinklet; Neozin; Optised; Prefrin-Z; Visine-AC; Zincfrin; Zink-Gro
Chemical formula	Zn	$ZnCl_2$[d]	$ZnSO_4$[d]
Chemical structure	Zn	Cl-Zn-Cl	
Identification numbers:			
CAS registry	7440-66-6	7646-85-7	7733-02-0
NIOSH RTECS	ZG8600000	ZH1400000	ZH5260000
EPA hazardous waste	No data	No data	No data
OHM/TADS	7216955	7216957	7216958
DOT/UN/NA/IMCO	Zinc, powder or dust, UN 1436; zinc, powder or dust, zinc ashes, IMO 4.3; zinc ashes, UN 1435	Zinc chloride, anhydrous, UN 2331; zinc chloride, solution, UN 1840; zinc chloride, anhydrous, solution, IMO 8.3	NA 9161
HSDB	1344	1050	1063
NCI	No data	No data	No data

[a]All information obtained from HSDB 1993 except where noted
[b]All information with the exception of HSDB number obtained from NIOSH 1990
[c]HSDB 1990
[d]Merck 1983

CAS = Chemical Abstracts Services; DOT/UN/NA/IMCO = Department of Transportation/United Nations/North America/International Maritime Dangerous Goods Code; EPA = Environmental Protection Agency; HSDB = Hazardous Substances Data Bank; NCI = National Cancer Institute; NIOSH = National Institute for Occupational Safety and Health; OHM/TADS = Oil and Hazardous Materials/Technical Assistance Data System; RTECS = Registry of Toxic Effects of Chemical Substances; Zn = zinc

TABLE 3-1. Chemical Identity of Zinc and Selected Compounds[a] *(continued)*

Characteristic	Zinc sulfide	Zinc oxide[b]
Synonym(s)	Wurtzite (alpha)[c]; Sphalerite (beta)[c]; zinc monosulfide	Calamine[c]; Zincite[c]; cynku tlenek (Polish); zinc monoxide; C-Weiss 8 (German); Blanc de Zinc; zincum oxydatum; zinci oxydum; zinci oxicum
Registered trade name(s)	Albalith; Irtran Z; CI pigment white 7; Sachtolith; Zinc blende	Akro-Zinc Bar 85[c]; Actox 14; Actox 16; Actox 216; Amalox; Azodox; Azo 22; Cadox XX 78; Chinese white; CI 77947; CI pigment white 4; Emanay zinc oxide; Emar; Felling zinc oxide; Flores de zinci; Flowers of zinc; Green seal-8; Hubbuck's white; Kadox 15; Kadox 72; Kadox-25; ozide; Ozlo; Permanent white; Philosopher's wool Powder base 900; Protox types 166, 167, 168, 169, 267, 268; Red seal-9; Snow white; Vandem VAC; Vandem VOC; Vandem VPC; White seal-7; XX 203; XX 78; Zinc white; Zinca 20; Zincoid; Zn 0701T; Electrox 2500; GIAP 10; Outmine; Unichem ZO; XX 601
Chemical formula	ZnS	ZnO
Chemical structure	Zn=S	Zn=0
Identification numbers:		
CAS registry	1314-98-3	1314-13-2
NIOSH RTECS	No data	ZH4810000
EPA hazardous waste	D003	No data
OHM/TADS	No data	No data
DOT/UN/NA/IMCO shipping	No data	No data
HSDB	5802	5024
NCI	No data	No data

TABLE 3-2. Physical and Chemical Properties of Zinc and Selected Compounds[a]

Property	Zinc	Zinc chloride	Zinc sulfate
Molecular weight	65.38	136.29	161.44
Color	Bluish-white, lustrous metal; distorted hexagonal closepacked structure	White granules (very deliquescent) or fused pieces/rods; fume is white[c]	Colorless rhombic crystals[b]
Physical state	Solid	Solid	Solid
Melting point	419.5℃	290℃	600℃ (decomposes)
Boiling point	908℃	732℃	No data
Density (g/cm^3)	7.14 at 25℃	2.907 at 25℃	3.54 at 25℃[b]
Odor	No data	Odorless; fume has acrid odor[c]	Not determined[d]
Odor threshold:			
Water	No data	No data	No data
Air	No data	No data	No data
Solubility:			
Water (mg/L)	Insoluble[b]	4.32×10^6 at 25℃; 6.14×10^6 at 100℃	Soluble in cold and hot water[b]; 1.7×10^6
Other solvent(s)	Soluble in acetic acid and alkali	1 g/1.3 mL alcohol; 1 g/2 mL glycerol; 1 g/0.25 mL 2% hydrochloroacetic acid	Slightly soluble in alcohol; soluble in methanol and glycerol[b]; 1 g/2.5 mL glycerol
Partition coefficients:			
K_d (mL/g)	0.1–8,000[e]; 40 (AVG)[f]; 939 in sandy loam soil; 12.2 in sandy soil[g]	No data	No data
Kow	No data	No data	No data
Koc	No data	No data	No data
Vapor pressure	1 mmHg at 487℃	1 mmHg at 428℃	Not determined
Henry's law constant	Not applicable	Not applicable	Not applicable
Autoignition temperature (Centigrade)	No data	Not flammable[h]	Not flammable[h]
Flashpoint	No data	Not flammable[h]	Not flammable[h]
Flammability limits	No data	Not flammable[h]	Not flammable[h]
Conversion factor:			
Solid	Not applicable	mg $ZnCl_2 \times 0.48$ = mg Zn	mg $ZnSO_4 \times 0.40$ = mg Zn
Explosive limits	No data	No data	No data

[a]All information obtained from Merck 1983 except where noted
[b]Weast 1988
[c]ACGIH 1991
[d]HSDB 1986
[e]Baes and Sharp 1983
[f]Baes et al. 1984
[g]Gerritse et al. 1982
[h]Weiss 1986

AVG = average; Zn = zinc; $ZnCl_2$ = zinc chloride; ZnO = zinc oxide; ZnS = zinc sulfide; $ZnSO_4$ = zinc sulfate

TABLE 3-2. Physical and Chemical Properties of Zinc and Selected Compounds[a] *(continued)*

Property	Zinc sulfide (α)	Zinc sulfide (β)	Zinc oxide
Molecular weight	97.45	97.45	81.38
Color	Colorless hexagonal crystals[b]	Colorless cubic crystals	White/yellowish-white powder; hexagonal crystals
Physical state	Solid	Solid	Solid
Melting point	1,700±20℃[b]	No data	100℃ (decomposes)
Boiling point	1,185℃ at 1 atm	1,185℃ at 1 atm	No data
Density (g/cm ^{3})	3.98 at 20℃[b]; 4.087 at 25℃	4.102 at 25℃	5.607 at 20℃
Odor	No data	No data	Odorless
Odor threshold:			
Water	No data	No data	No data
Air	No data	No data	No data
Solubility:			
Water (mg/L)	6.9 at 18℃[b]	6.5 at 18℃[b]	1.6 at 29℃[b]
Other solvent(s)	Very soluble in alcohol; soluble in dilute mineral acids; insoluble in acetic acid; insoluble in alkalies	Very soluble in alcohol; soluble in dilute mineral acids; insoluble in alkalies	Soluble in dilute acetic or mineral acids, ammonia, ammonium carbonate, fixed alkali hydroxide solution, and ammonium chloride[b]; insoluble in alcohol[b]
Partition coefficients:			
Kd (mL/g)	No data	No data	No data
Kow	No data	No data	No data
Koc	No data	No data	No data
Vapor pressure (mm Hg)	No data	No data	Not applicable
Henry's law constant	Not applicable	Not applicable	Not applicable
Autoignition temperature (Centigrade)	No data	No data	Not flammable[h]
Flashpoint	No data	No data	Not flammable[h]
Flammability limits	No data	No data	Not flammable[h]
Conversion factor:			
Solid	mg ZnS × 0.67 = mg Zn	mg ZnS × 0.67 = mg Zn	mg ZnO × 0.80 = mg Zn
Explosive limits	No data	No data	No data